5 TR-200 MULTIPLEXER

The TR-200 16-pole coaxial multiplexer has 16 BNC female connectors around the edges, and 1 BNC female connector near the center for connection to the cable tester or another multiplexer (Fig. 5-1). It requires a 12 VDC power line and a ground line, and 3 TTL level digital lines for addressing; all of which are connected through a five pole, polarized connector (Fig. 5-1). It has been successfully controlled using personal computers. It should be possible to program the addressing (8 synchronous serial bits) using a datalogger (e.g. Campbell Sci., Inc. CR10, 21X or CR7). Data on performance of the multiplexer are reported in Evett (1998)(see addendum 1 to this text).

A five pole connector is numbered and the power and control lines should be connected as follows:

Pin no.	Description
1	Ground or negative pole of 12 volt battery
2	12 volts DC power
3	SDE (serial device enable, pin 4 of PC's parallel port)
4	DATA (pin 2 of PC's parallel port)
5	CLK (clock, pin 3 of PC's parallel port)

The parallel port pin numbers are those used in the TR-2200 cable set and are those used by programs TACQ and TR200TST.BAS to control the multiplexer. Both programs may be downloaded from http://www.cprl.ars.usda.gov/programs (Microsoft BASIC source code included or TR200TST.BAS). Cable TR-2200B is connected to the multiplexer. These are the default pin number assignments used in the TACQ TDR data acquisition program. They may be changed if the cable wiring to the parallel port is changed accordingly. A diagrammatic view of the top of the multiplexer is given in Figure 5-1. The 5 pole connector is at the right and is numbered 1 to 5. The 16 BNC input connectors are numbered 1 through 8 from right to left on the bottom side of the figure and 9 through 16 from left to right on the top side of the figure. Note that the computer or data logger and the multiplexer must share a common DC ground. For example, if a laptop is connected to 120 volt AC power through a wall outlet, while the multiplexer is connected to a battery, the signals from the laptop's parallel port will float in reference to the battery ground and the multiplexer will not respond to signals or will respond unreliably. The solution is to run a ground wire between pins 24 or 25 on the laptop's parallel port and the ground on the multiplexer (pin 1). If the laptop (PC, or datalogger) and the multiplexer are powered by the same source (e.g. a 12 volt battery or solar system) then the ground wire should run from pins 24-25 to the negative side of the battery. The correct grounds are implemented in the TR-2200 cable set.

The multiplexer is serially addressed using an 8 bit clocked data stream. Four bits are used to specify one of the 16 inputs and the other 4 bits are used to specify the address of the multiplexer itself. The multiplexer may be set to one of 16 addresses by moving a jumper on the back (bottom of lower of two printed circuit boards). Figure 5-2 shows the positions that the jumper may occupy, numbered by address. The jumper is set for address 1 at the factory. The address number is the decimal number that is input to subprogram LINEADDRESS in program TR200TST.BAS. Subprogram LINEADDRESS then forms a binary address that is sent through the parallel port by subprogram VAZECCONTROL.

Subprogram LINEADDRESS is also used to convert the decimal input channel number to binary for use by subprogram VAZECCONTROL in setting the multiplexer to the desired input channel. These

subprograms have been used for automatic data acquisition on a pre-set time interval in the program TACQ.EXE. Note that the multiplexer may be set to any input channel at any time. There is no requirement that the channels be used in any set order, nor do all of the 16 channels have to be used.

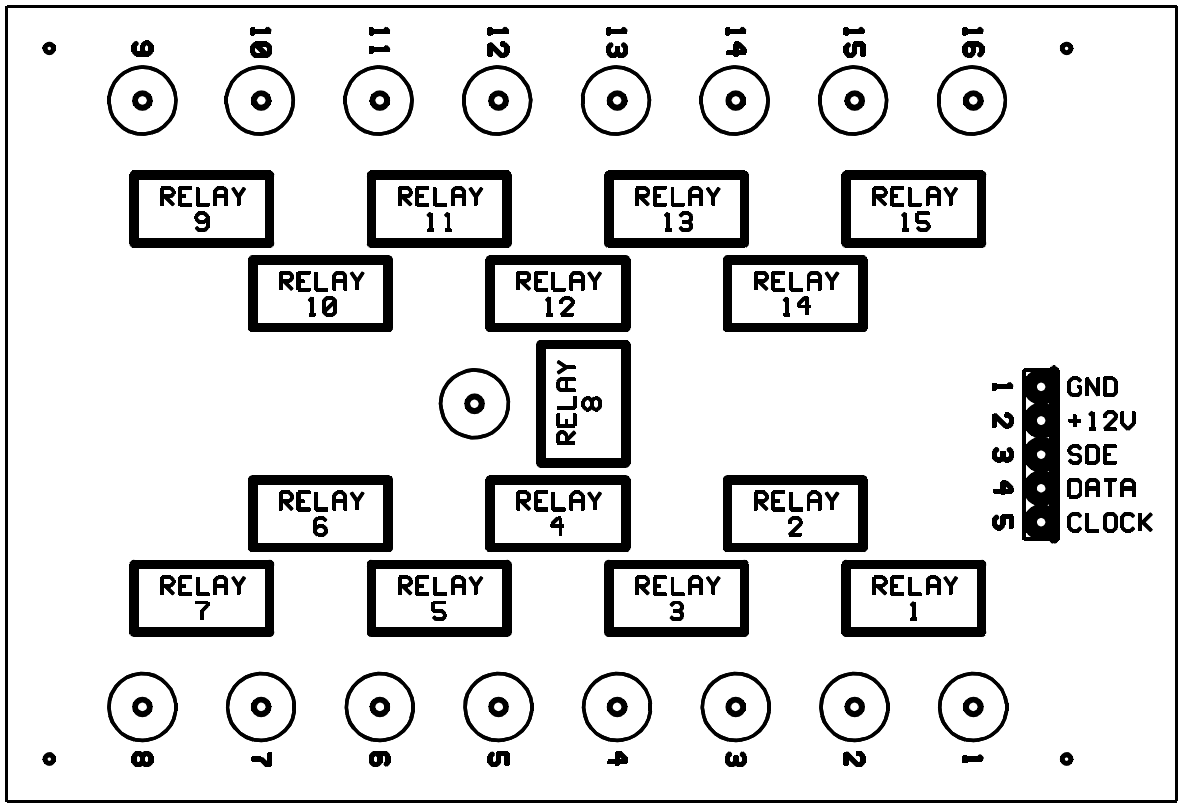

Figure 5-1. Vadose coaxial multiplexer, model TR-200, top view. Numbered concentric circles are BNC sockets, channels 1 through 16. Center BNC connector is for connection to primary multiplexer or to cable tester. Five pin, polarized power and control connector is at right.

Program TR200TST.BAS will control the multiplexer using any IBM PC/XT/AT compatible personal computer equipped with a parallel port configured as LPT1 or LPT2. Program TACQ.EXE controls the TR-200 or Cambell Scientific, Inc (CSI) multiplexers and allows automatic or manual data collection using a system equipped with a Tektronix 1502B or C connected to the PC's serial port. Alternatively, a modified Tektronix 1502 cable tester may be used. You are free to include code from program TR200TST.BAS in your own TDR data acquisition program.

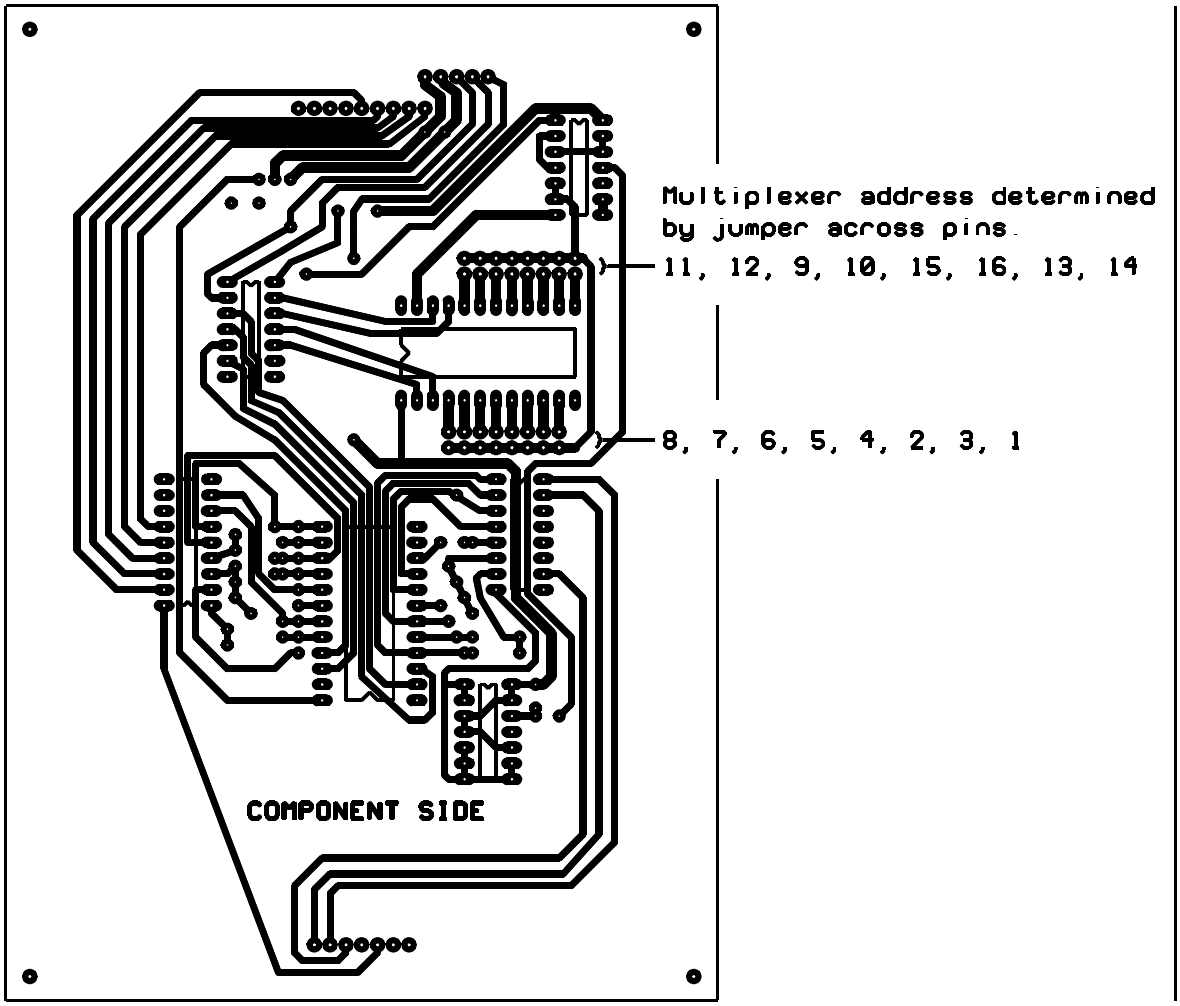

Figure 5-2. Vadose coaxial multiplexer, model TR-200, bottom view showing positions of the jumper for the 16 multiplexer addresses.

The CSI documentation for the model SDMX50 coaxial multiplexer describes the use of this multiplexer. Connections between the parallel port and the SDMX50 are similar but not identical to those described above. The connector on the SDMX50 does not have numbers, but a decal on the door of the multiplexer housing describes the connections as +12, GND, C1, C2, and C3. The connections to the parallel port are as follows:

Connection	Description
GND	Ground or negative pole of 12 volt battery
+12	12 volts DC power
C1	DATA (pin 6 of PC's parallel port)
C2	CLK (clock, pin 7 of PC's parallel port)
C3	SDE (serial device enable, pin 8 of PC's parallel port)

These pin assignments are the defaults used by program TACQ. Note that the parallel port pin numbers may be changed from the default values given above for connection of the Vadose or CSI multiplexers. For example pins 2, 3 and 4 of the parallel port might be used to control the SDMX50 rather than the TR-200.

REFERENCES

Evett, S.R. 1998. Coaxial multiplexer for time domain reflectometry measurement of soil water content and bulk electrical conductivity, Trans. ASAE 40(1):361-369.